

§ 2003 年

1. $r = 1 + \cos \theta$ is a cardioid ◦ At the point $(r, \theta) = (2, 0)$, $K = \text{curvature} = ?$

2. $\frac{x^2}{9} + \frac{y^2}{4} + \frac{z^2}{1} = 1$ is an ellipsoid ◦ At the point $(x, y, z) = (3, 0, 0)$, $K = \text{Gauss curvature} = ?$

3. $\{x^2 + y^2 = 1 \mid x, y \in \mathbf{R}\}$ is a circle ◦ Is it simply connected ?

4. 2×2 matrices $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ with determinant $\begin{vmatrix} a & b \\ c & d \end{vmatrix} = 1$ form a subset of \mathbf{R}^4 ◦ Is it a compact subset ?